PATENT SPECIFICATION

DRAWINGS ATTACHED

856,506

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COMPLETE SPECIFICATION

Improvements in or relating to Telescopic Shock Absorbers

We, FIRMA RHEINMETALL G.m.b.H., a Company recognised by German Law, of Ratherstrasse 110, Düsseldorf, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to telescopic shock absorbers for use in motor vehicles, of the type having air cushions to compensate for the effect of the volume of the piston rod.

It has been proposed to locate the air cushion at the top of the cylinder space swept by the piston and to connect it by passages with the working space of the absorber. In that design the piston of the absorber is not linked to the chassis—as is usual—but with the wheel axle.

It has also been proposed to employ a floating piston acted upon by a spring on the side of the absorber remote from the piston rod whereby the floating piston forms the movable wall of a compensating chamber.

Also it has been suggested that the air cushion may be located in a bell-shaped projection of the piston on the side remote from the piston rod. Here again the air cushion is separated from the damping liquid by a floating piston.

Further, it has also been proposed to employ a separate container above the absorber itself in which the air cushion is located and which is in communication with the damping liquid via a longitudinal passage in the piston rod, the end of the piston rod being flush with the bottom of the container.

It is an object of the invention to provide a shock absorber which can be operated in any position and which in addition is characterised by a particularly simple construction suitable for mass production and also by high reliability in use.

According to the present invention a telescopic shock absorber assembly comprises in combination, a cylinder, a piston movable within the cylinder, movement damping liquid in said cylinder, a hollow body, an inlet orifice in the wall of said hollow body which is otherwise closed whereby a quantity of damping liquid is retained in said hollow body only partially filling the latter, the level of said quantity of liquid being at all times such that said inlet orifice remains covered.

In order to provide maximum safety against an escape of air in any position of the absorber liable to be encountered in practical use the tube will preferably be so designed that in the position of the absorber likely to be used the distance of the exit section of the tube from the level of the liquid is as great as practicable.

According to a further subsidiary feature of the invention undesirable turbulence in the damping liquid liable to give rise to foaming and the formation of an emulsion is prevented by the provision of steadying means reducing turbulence, for example a perforated baffle hood, at the exit of the above mentioned tube, in order to reduce turbulence.

Within the framework of the invention it may also be of advantage to give the hollow body, at least on the inside, a spherical or similar geometrical shape. For this feature will result in particularly good utilization of the capacity of the hollow body in that a particularly large amount of air can then be contained inside the hollow body for any given dimensions of the latter, without danger of escape of air when the absorber assumes an inclined position.

In specially difficult cases, i.e., in cases in which the effect of a particularly large volume of piston rod has to be compensated, it is possible according to the invention to build the hollow body up from a number of individual compartments separated by partition walls which are connected to the damping liquid by means of a common tube.

The hollow body containing the air cushion can according to the invention be located in a

[*Price 3s. 6d.*]

variety of positions, for example, above or below the piston, within the hollow piston rod or at any other suitable position.

However, a design affording a particularly large saving of space will be achieved if the hollow body described above is at the same time used as the dashpot piston. If this feature is used it may be of advantage to fit the top and bottom end faces of the hollow body with valves functioning in the manner of flat springs which control the clearance space between the piston and the cylinder which bend in one direction as determined by the contour of the end face of the hollow body. By suitable design of these contours, particularly also of the edges of the end faces, it is possible to vary the extent to which the spring valves bend when subjected to the operating pressure of the damping fluid, and hence also the size of the clearance between the piston and the cylinder, i.e., the characteristic behaviour of the damping. In that case it would, for example, be possible to provide the end faces also with groove-shaped recesses of annular form into which the spring valve could be forced to a greater or lesser extent by the liquid pressure.

A number of embodiments of the invention is illustrated in the drawing in which:—

Fig. 1 shows a detail of the shock absorber, namely the piston, taking the shape of a hollow body in accordance with the invention, with the neighbouring parts, in longitudinal section,

Fig. 2 shows another embodiment in a view corresponding to Fig. 1 but with a piston in the form of a hollow body containing two compartments with two air cushions in parallel,

Fig. 3 shows a third embodiment partly in section in which the hollow body, which is used as a space compensating for the effect of the volume of the piston rod, is located near the bottom end of the absorber, and

Fig. 4 shows a fourth embodiment in which the compensating space is located near the upper connecting lug of the absorber.

In a first embodiment shown in Fig. 1, the cylinder of the shock absorber is designated by 1, the piston rod by 2 and the piston assemby of the dashpot by 3. The piston itself consists in this case of two tightly joined shells 3*a* and 3*b* of which the latter is joined to the piston rod 2. The hollow piston 3 thereby formed is only partly filled with a damping liquid 4 leaving an air cushion 5 whose volume is such that it is capable of compensating the effect of changes in the volume of the piston rod inside the cylinder 1.

The inside of the shells 3*a*, 3*b* is in communication with the damping liquid 7 by means of a tube 6 rigidly connected to the shell 3*a*. The tube 6 is so shaped and the amount of liquid 4 filling the hollow space is so arranged that the exit 8 of the tube 6 is below the level 9 of the liquid in all positions of the dashpot. In this manner an adequate volume of air is trapped in the air cushion 5 for all operating positions of the absorber. In order to prevent foaming and the formation of an emulsion, a baffle hood 11 provided with perforations 10 is fitted to the exit 8 of the tube, in order to steady the flow.

Valve plates 12 and 13 are provided at the top and bottom of the piston respectively which are normally flat but which bend when subjected to the dynamic pressure of the damping liquid 7. In this manner the flow of liquid through the clearance 14 provided between the piston and cylinder wall can be controlled in a simple manner by means of the valve plates 12, 13. The characteristic of this control can be varied within wide limits in one direction by giving a suitable shape to the end faces 15 and 16 of the piston, since the plate valve will, as can be seen in the case of the valve plate 12 in Fig. 1, be urged by the dynamic fluid pressure against the neighbouring piston end face.

The embodiment shown in Fig. 2 is generally of similar construction except that here there is not one hollow body but two. Shells 3*a* and 3*b* containing air cushions 5*a* and 5*b* have a central partition 17 but are in communication, as it were, in parallel, with the damping liquid 7 by means of a tube 6*a* with branches 6*b* and 6*c*. Here again, baffle hoods or caps 11 having perforations 10 are fitted over the exits 8*a* and 8*b* of branches 6*b* and 6*c* respectively. The partition 17 separating the two compartments of the piston from each other can be provided with a number of guide projections 14*a*, for example in the shape of teeth, at its circumference, extending into the clearance 14 and which slide along the inner wall of the cylinder when the piston moves up or down, thereby guiding the latter. The embodiment of Fig. 2 is intended in particular for cases in which compensation must be provided for the effect of a large volume of piston rod inside the cylinder.

In a third embodiment shown in Fig. 3 the air cushion is located at the foot of the absorber. For this purpose the cylinder 1 of the absorber is extended downwardly as at 18 which at the same time is used for the attachment of the connecting lug 19. A partition consisting of the clamping ring 20, the seal 21 and the flange 22 with the short pipe 23 ensures the retention of the air cushion 5*c* in all positions of the dashpot for the purpose of compensating for the effect of the volume of the piston rod. The flange 22 is at the same time used as the seating for a valve plate 25 containing control orifices 26. The upward travel of this valve plate is limited by the inwardly extending edge of the clamping ring 20.

A further embodiment is shown in Fig. 4 in which the air cushion 5*d* is located at the top end of the absorber. For this purpose the cylinder wall 27 of the absorber is extended

upwardly at 28 and is connected rigidly to the piston rod 30 by means of a plate 29. The piston rod 30 is hollow; its free end 30*a* forms at the same time the stand pipe of the hollow body containing the air cushion 5*d*. The liquid filling the space 4*d* reaches the level 9 and is in communication with the damping liquid 7 by means of the hollow piston rod. 31 designates the piston rod seal of the absorber.

It is possible to provide a baffle hood or like component for the exit 8*d* of the stand pipe 30*a* in this case as well; however, in most cases such a feature will be unnecessary since here the liquid will already have been steadied sufficiently when it enters the hollow space since it has passed along the comparatively long pipe of the piston rod. Thus the air cushion is in this embodiment protected very effectively against escape of air due to the particular type of provision for the air cushion and the hollow body.

WHAT WE CLAIM IS:—

1. A telescopic shock absorber assembly comprising in combination, a cylinder, a piston movable within the cylinder, movement damping liquid in said cylinder, a hollow body, an inlet orifice in the wall of said hollow body which is otherwise closed whereby a quantity of damping liquid is retained in said hollow body only partially filling the latter, the level of said quantity of liquid being at all times such that said inlet orifice remains covered.

2. A telescopic shock absorber assembly comprising in combination a cylinder, a piston movable within the cylinder, a piston movement damping liquid within the cylinder, a hollow body, a tube having an inlet and an outlet, the tube passing through the wall of said hollow body which is otherwise closed whereby the outlet of the tube is within the hollow body and interflow of liquid can take place between the liquid in the cylinder and the quantity of damping liquid within the hollow body, the said quantity being sufficient to partially fill the latter and the level being such that at all times the outlet of the tube remains covered.

3. A shock absorber assembly as claimed in claim 2 in which there is a perforated baffle hood fitted over the outlet of the tube.

4. A shock absorber assembly as claimed in claim 2 in which the hollow body is divided by a partition into two parts, and in which the tube has a single inlet located outside the hollow body and two outlets each of which is within a different one of the two parts whereby interflow of liquid can take place between the liquid in the cylinder and quantities of liquid in the parts sufficient only to partially fill each of the latter, the levels of liquid in the parts being at all times such that the outlets therein remain covered.

5. A shock absorber assembly as claimed in claim 4 and further comprising two perforated baffle hoods each secured over a different one of said outlets.

6. A shock absorber assembly as claimed in any one of the preceding claims in which the hollow body comprises the head of the piston.

7. A shock absorber assembly as claimed in claim 6 and further comprising valve plates secured to opposite faces of said piston head for controlling the clearance between said head and said cylinder.

8. A telescopic shock absorber assembly comprising in combination a cylinder, a piston movable within the cylinder, a piston movement damping liquid within the cylinder, an apertured partition dividing the cylinder into a first and a second part, a tube having an inlet and an outlet, said outlet being joined to the apertured partition and the tube extending into the second part, a quantity of damping liquid in the second part sufficient only partially to fill the latter and to maintain said outlet beneath the surface of said quantity of damping liquid.

9. A shock absorber assembly as claimed in claim 8 and further comprising, in said tube adjacent said inlet, a valve seating and a valve member located in said seating.

10. A telescopic shock absorber assembly comprising in combination a cylinder, a piston assembly movable in said cylinder and comprising a hollow piston rod, a hollow body into which said hollow piston rod projects and to which the latter is secured, a movement damping liquid in said cylinder, a quantity of movement damping liquid in said hollow body sufficient to partially fill the latter and to maintain the inlet of said hollow piston rod below the level of said quantity of liquid, communication between said quantity of liquid and the liquid in said cylinder being effected via the hollow piston rod.

11. A shock absorber assembly as claimed in any one of the preceding claims wherein the interior contour of the hollow body is substantially spherical.

12. A telescopic shock absorber substantially as described with reference to and as illustrated by figure 1 or figure 2 or figure 3 or figure 4 of the accompanying drawings.

ABEL & IMRAY,
Agents for the Applicants,
Quality House, Quality Court,
Chancery Lane, London, W.C.2.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale.*

SHEET 1

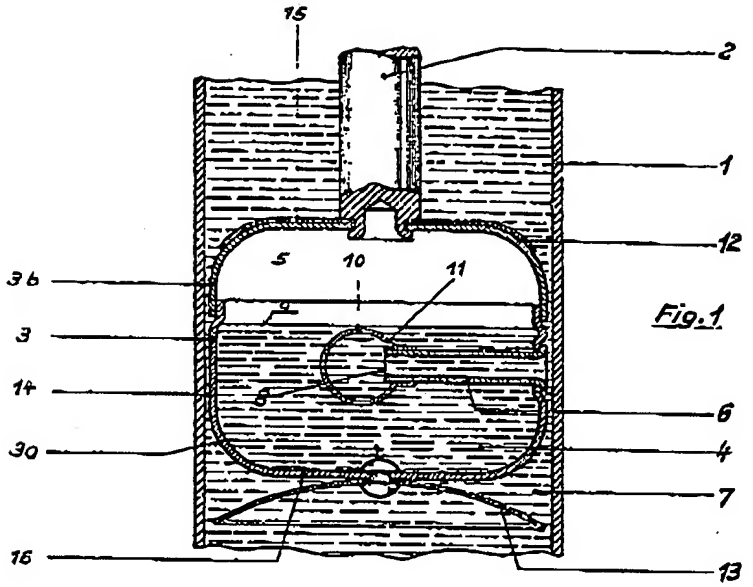

Fig. 1

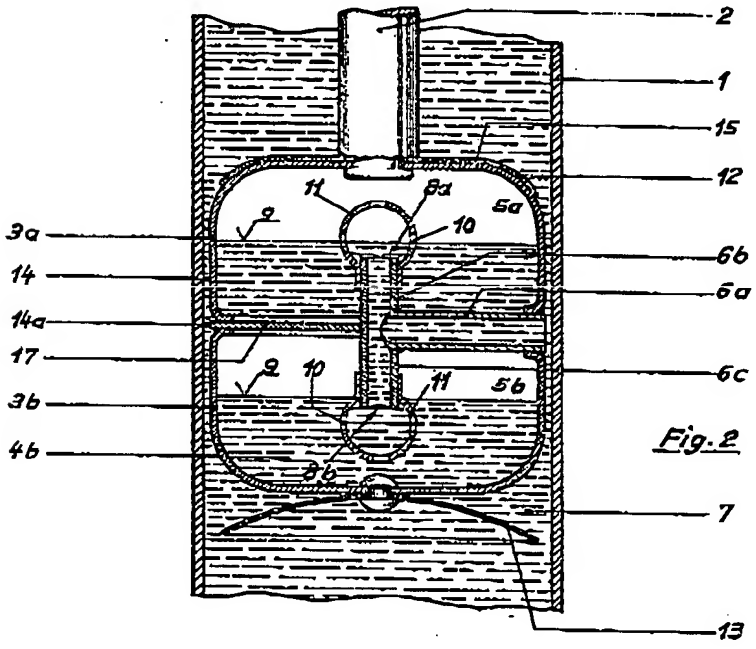

Fig. 2

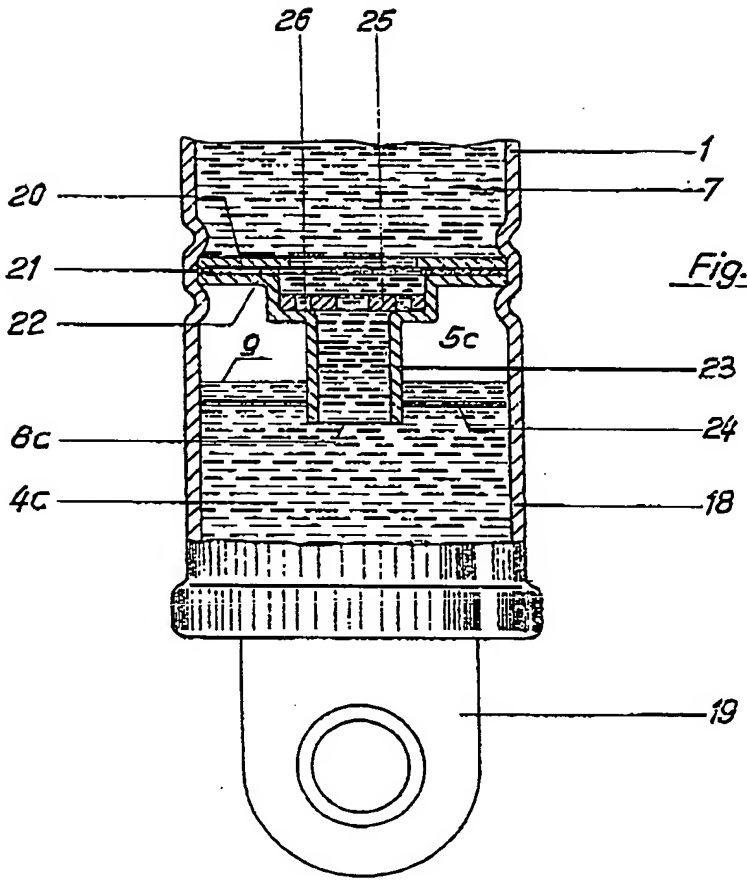

Fig. 3

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3 SHEETS

This drawing is a reproduction of the Original on a reduced scale.

SHEETS 2 & 3

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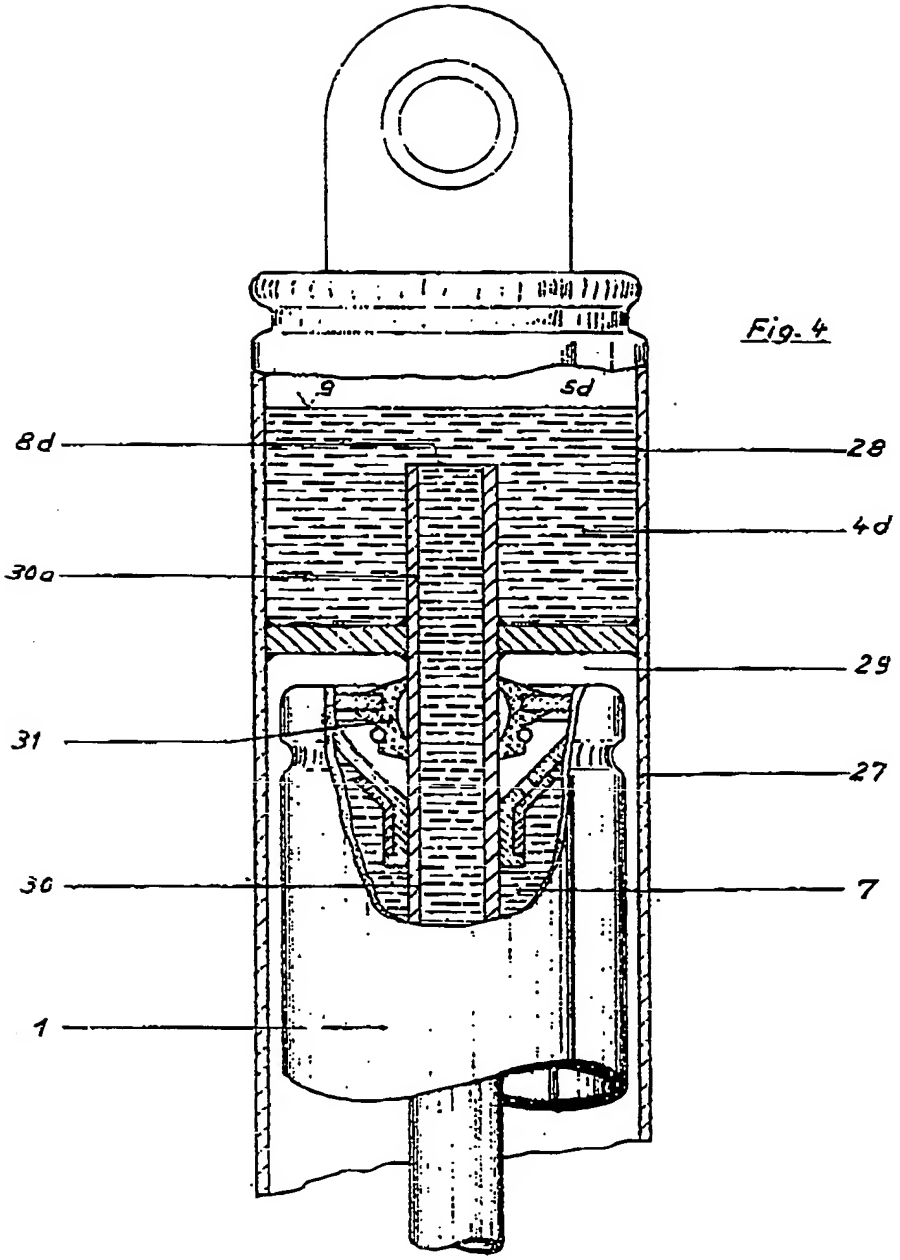

Fig. 4

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This drawing is a reproduction of the Original on a reduced scale.

SHEETS 2 & 3

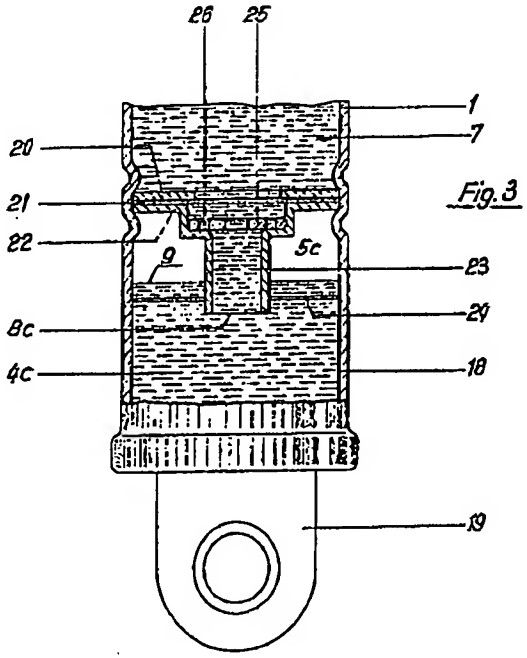

Fig. 3

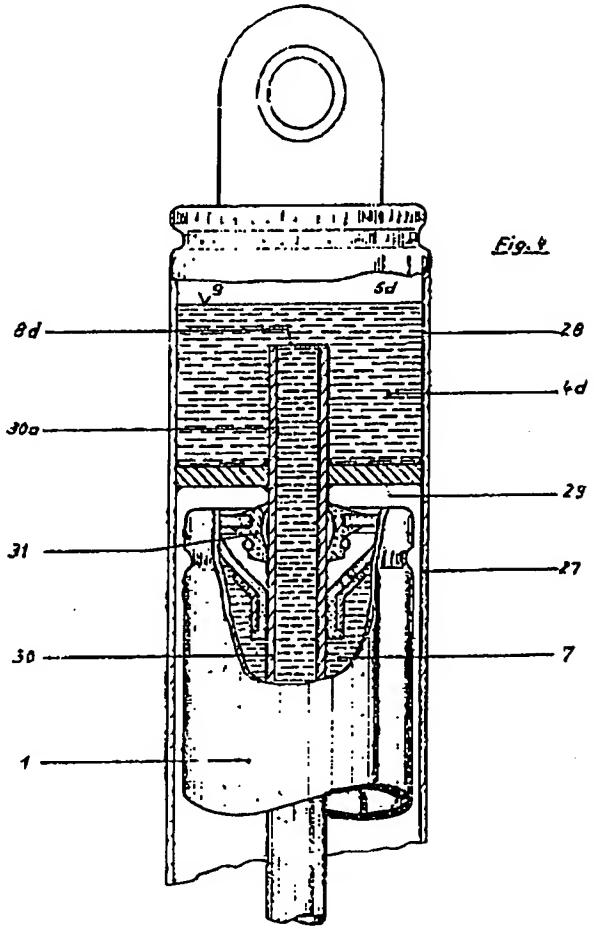

Fig. 4